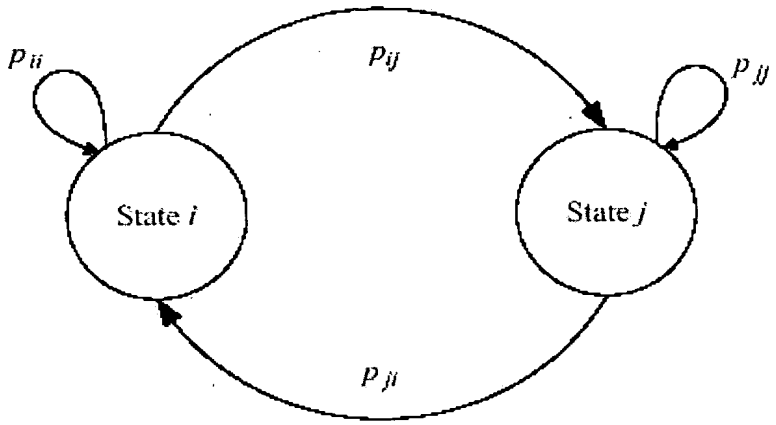
p_{ij} = Pr{System will switch to state j given that it is currently in state i}



$$\Pi \equiv \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1N} \\ p_{21} & p_{22} & \cdots & p_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ p_{N1} & p_{N1} & \cdots & p_{NN} \end{bmatrix}$$

N = Number of models

Fig. 1

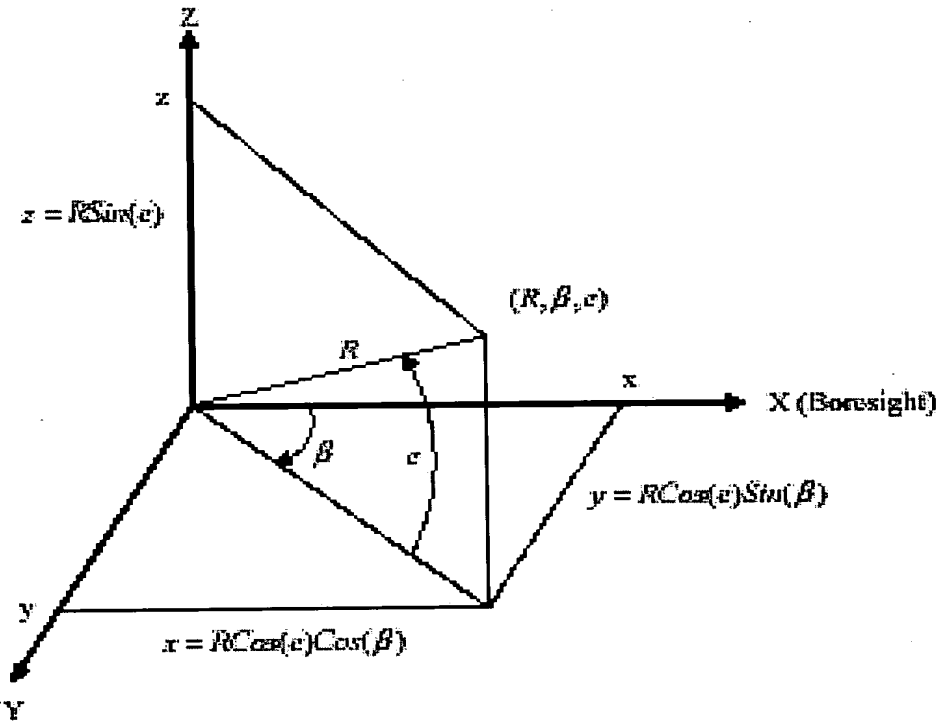

Z
z
$z = R\mathrm{Sin}(e)$
(R,β,e)
R
x
X (Boresight)
β
e
$y = R\mathrm{Cos}(e)\mathrm{Sin}(\beta)$
y
$x = R\mathrm{Cos}(e)\mathrm{Cos}(\beta)$
Y

Fig. 2

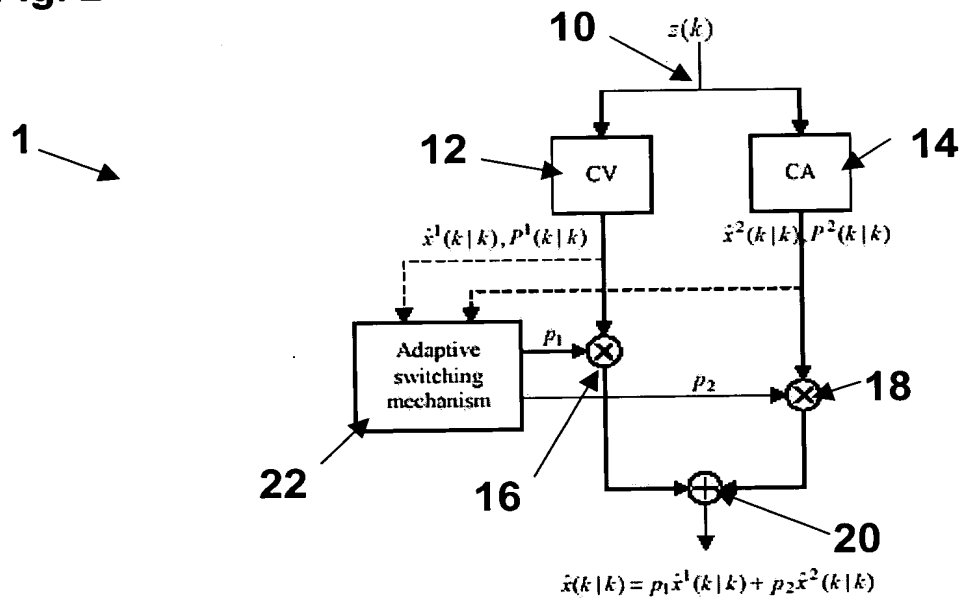

1
10
$z(k)$
12
CV
CA
14
$\hat{x}^1(k|k), P^1(k|k)$
$\hat{x}^2(k|k), P^2(k|k)$
Adaptive switching mechanism
p_1
p_2
18
22
16
20
$\hat{x}(k|k) = p_1\hat{x}^1(k|k) + p_2\hat{x}^2(k|k)$

Fig. 3

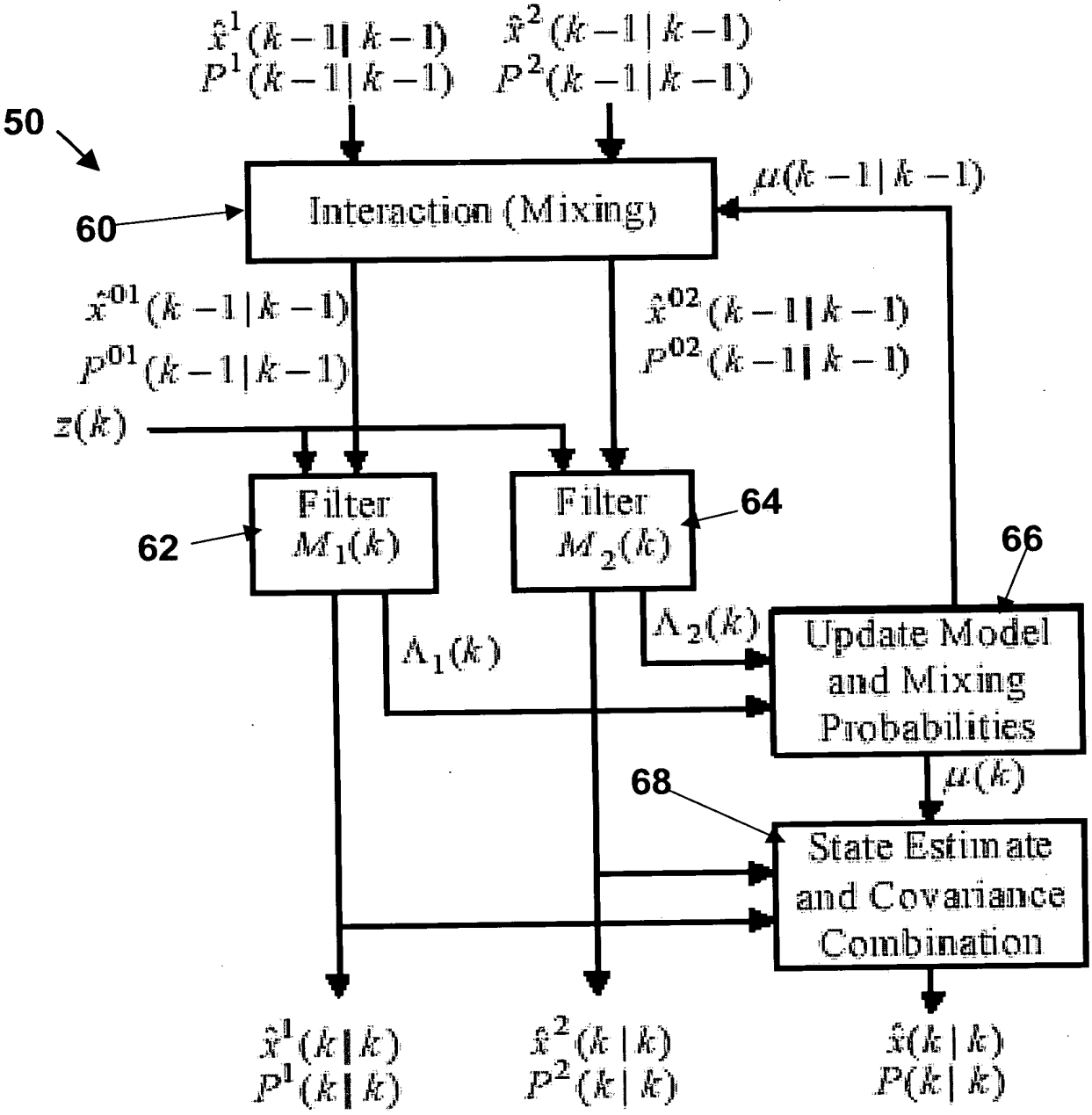

$\hat{x}^1(k-1|k-1)$
$P^1(k-1|k-1)$
$\hat{x}^2(k-1|k-1)$
$P^2(k-1|k-1)$
50
60
Interaction (Mixing)
$\mu(k-1|k-1)$
$\hat{x}^{01}(k-1|k-1)$
$P^{01}(k-1|k-1)$
$\hat{x}^{02}(k-1|k-1)$
$P^{02}(k-1|k-1)$
$z(k)$
62
Filter
$M_1(k)$
Filter
$M_2(k)$
64
66
$\Lambda_2(k)$
$\Lambda_1(k)$
Update Model and Mixing Probabilities
$\mu(k)$
68
State Estimate and Covariance Combination
$\hat{x}^1(k|k)$
$P^1(k|k)$
$\hat{x}^2(k|k)$
$P^2(k|k)$
$\hat{x}(k|k)$
$P(k|k)$

Fig. 4A

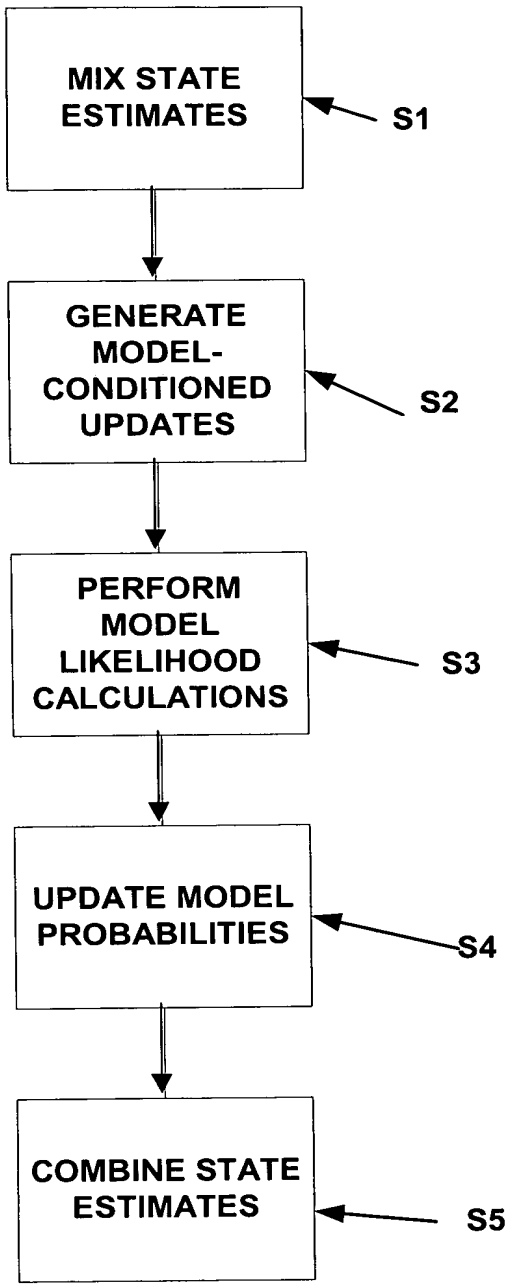

MIX STATE ESTIMATES
S1
GENERATE MODEL-CONDITIONED UPDATES
S2
PERFORM MODEL LIKELIHOOD CALCULATIONS
S3
UPDATE MODEL PROBABILITIES
S4
COMBINE STATE ESTIMATES
S5

Fig. 4B

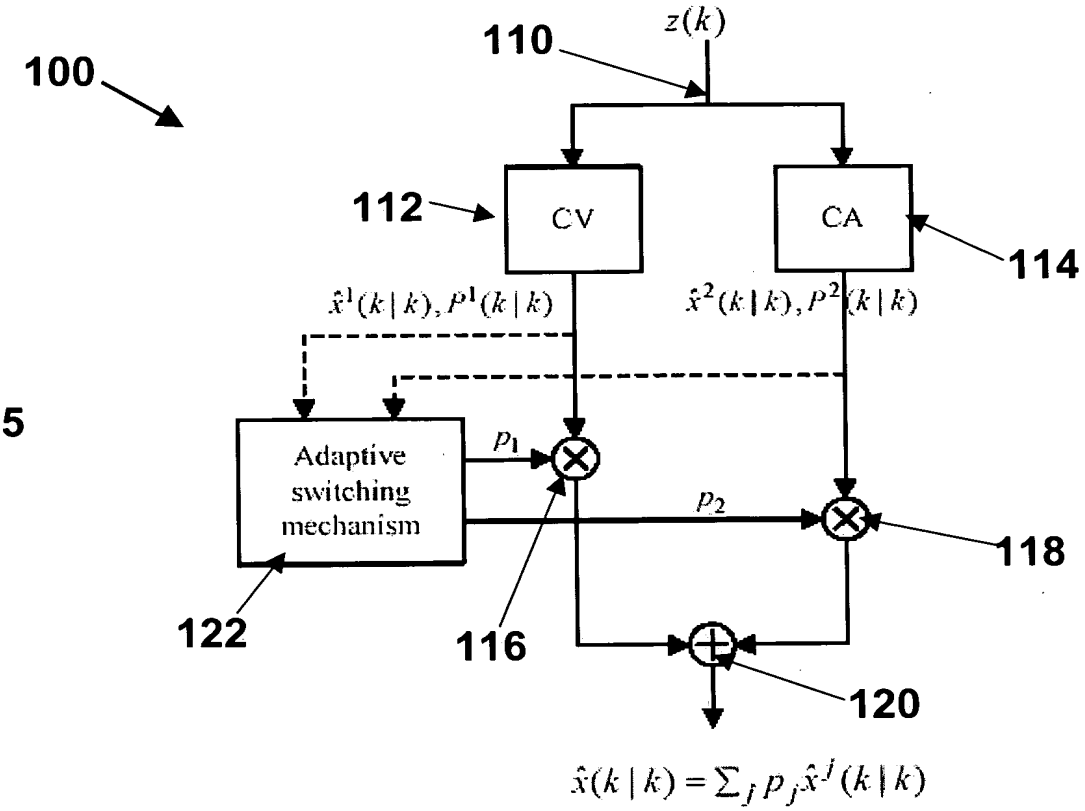

100
110
$z(k)$
112
CV
CA
114
$\hat{x}^1(k|k), P^1(k|k)$
$\hat{x}^2(k|k), P^2(k|k)$
Adaptive switching mechanism
p_1
p_2
118
122
116
120
$\hat{x}(k|k) = \sum_j p_j \hat{x}^j(k|k)$

Fig. 5

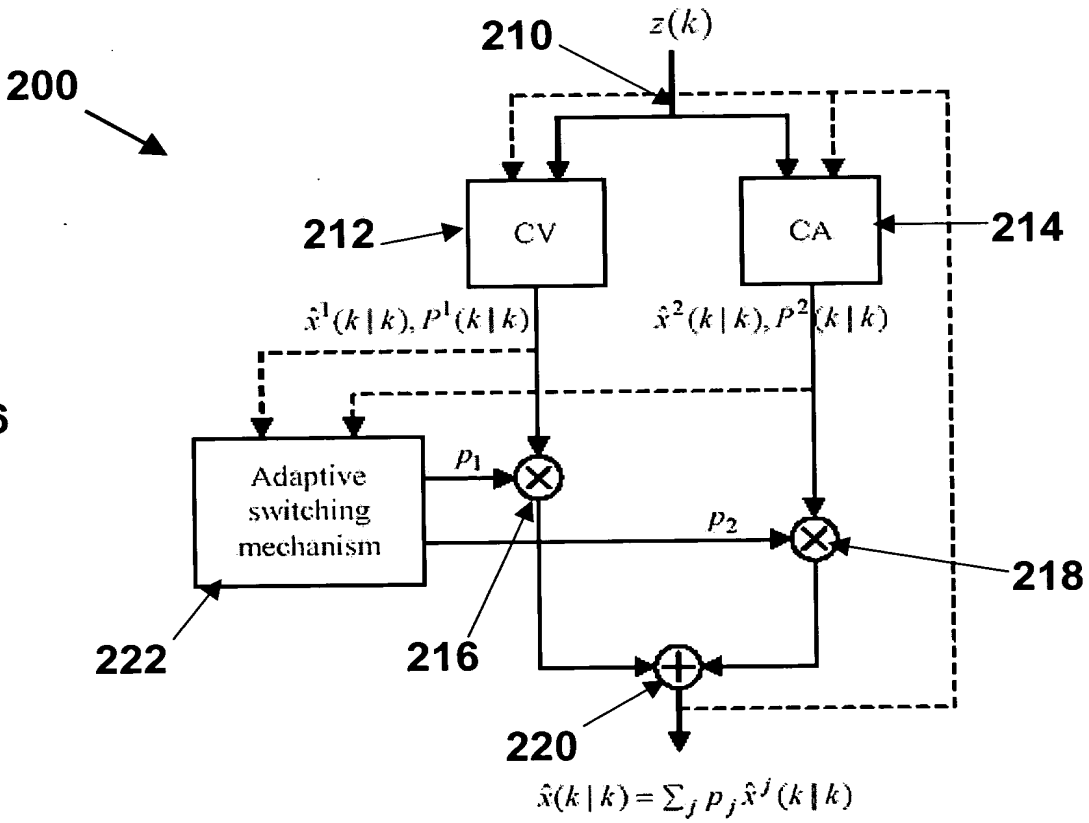
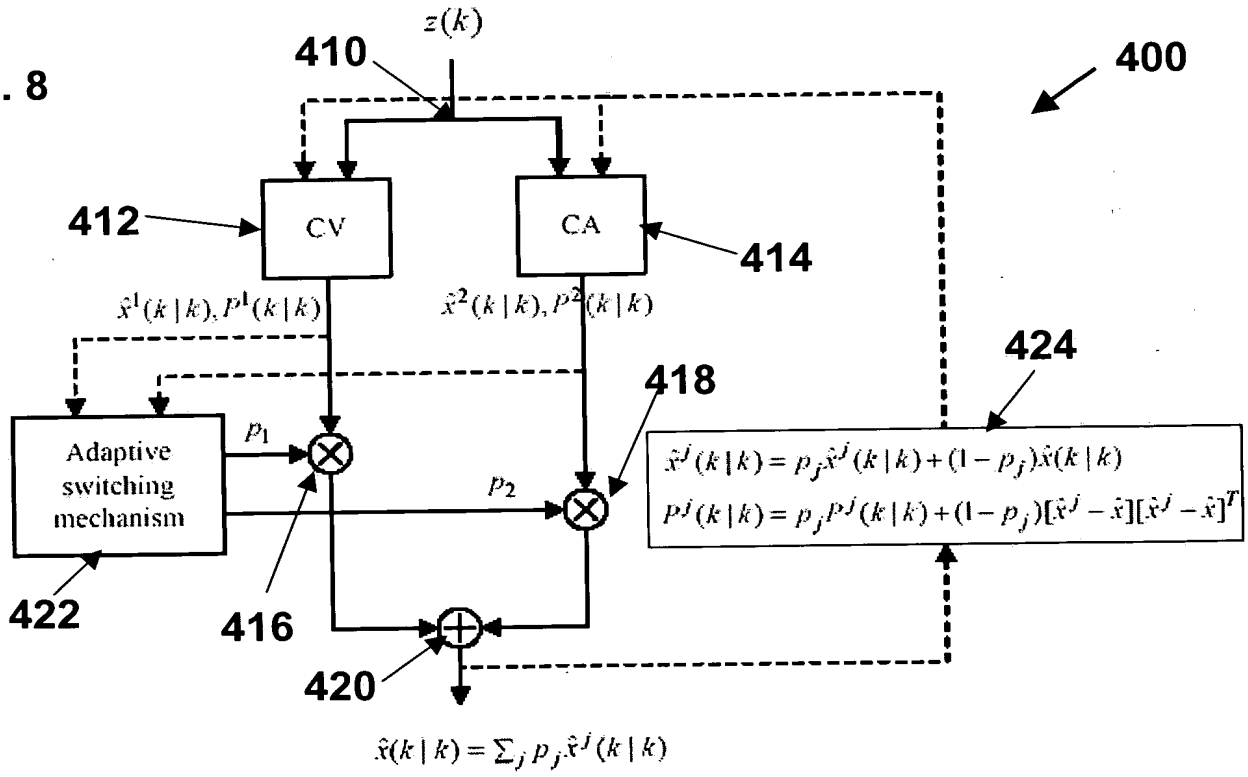

200
210
$z(k)$
212
CV
CA
214
$\hat{x}^1(k|k), P^1(k|k)$
$\hat{x}^2(k|k), P^2(k|k)$
Adaptive switching mechanism
p_1
p_2
218
222
216
220
$\hat{x}(k|k) = \sum_j p_j \hat{x}^j(k|k)$

Fig. 6

Fig. 8


$z(k)$
410
400
412
CV
CA
414
$\hat{x}^1(k|k), P^1(k|k)$
$\hat{x}^2(k|k), P^2(k|k)$
424
418
Adaptive switching mechanism
p_1
p_2
$\hat{x}^j(k|k) = p_j\hat{x}^j(k|k) + (1-p_j)\hat{x}(k|k)$
$P^j(k|k) = p_j P^j(k|k) + (1-p_j)[\hat{x}^j - \hat{x}][\hat{x}^j - \hat{x}]^T$
422
416
420
$\hat{x}(k|k) = \sum_j p_j \hat{x}^j(k|k)$

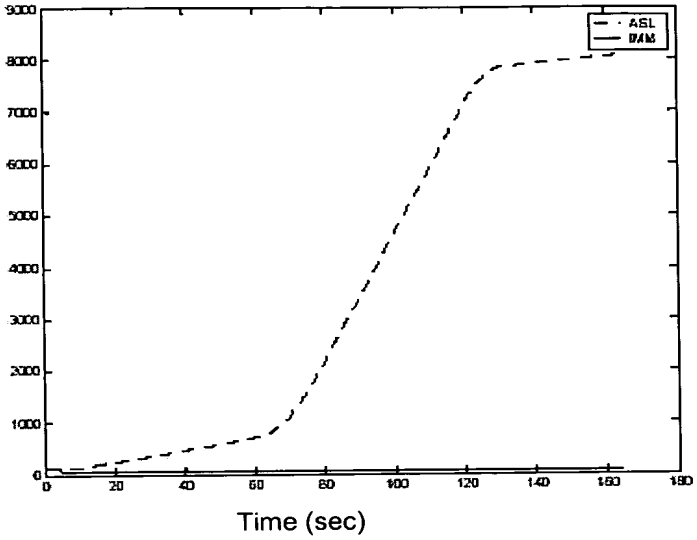


Fig. 10A

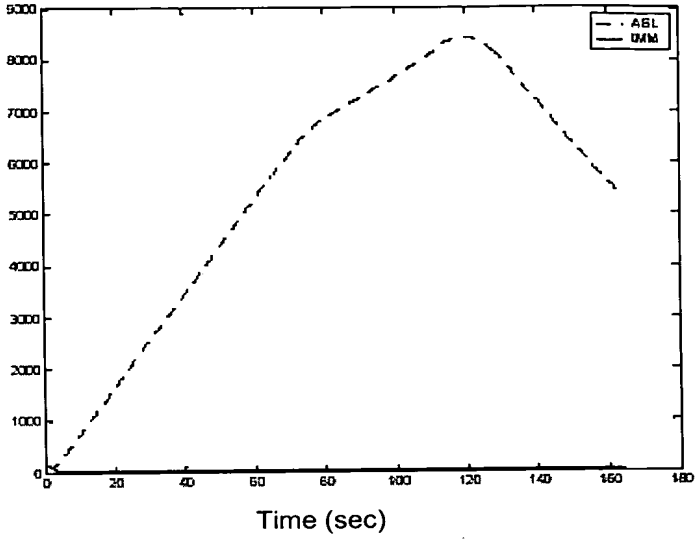


Fig. 10B

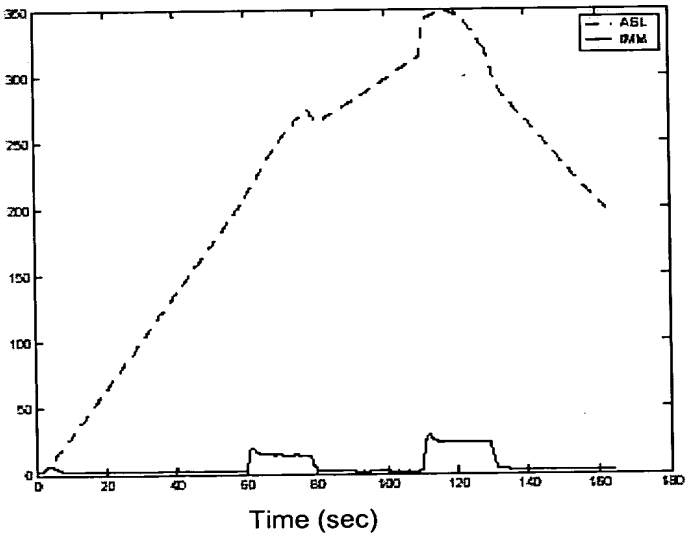


Fig. 10C

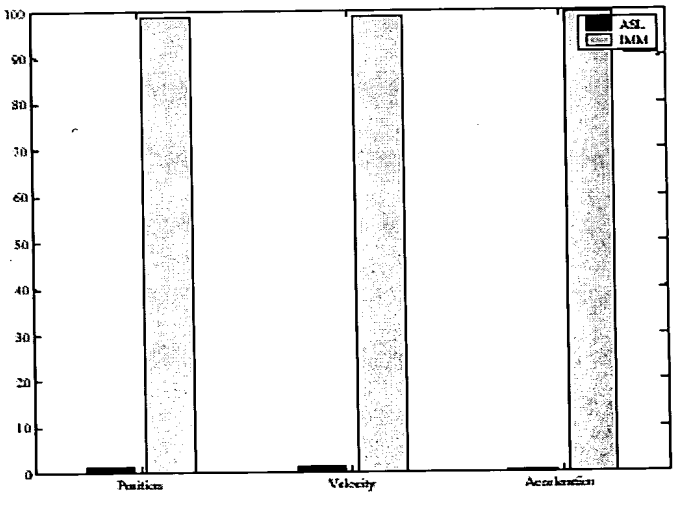


Fig. 10D

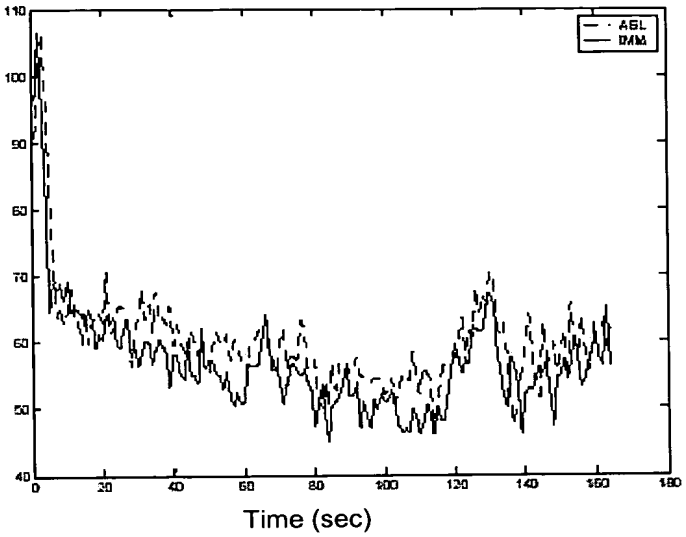


Fig. 11A

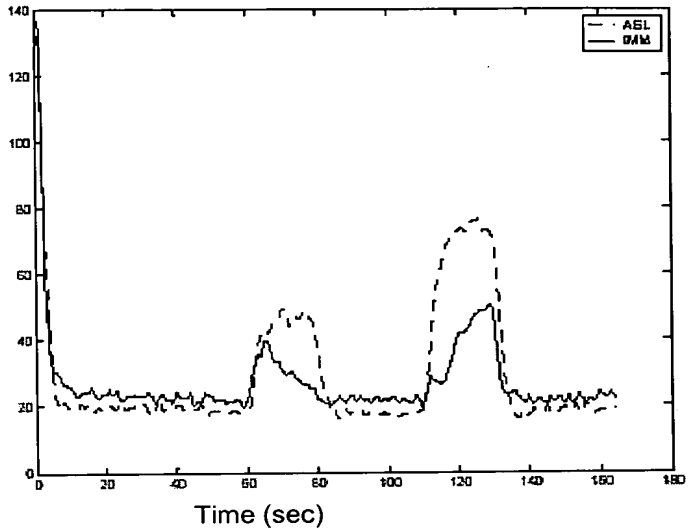


Fig. 11B

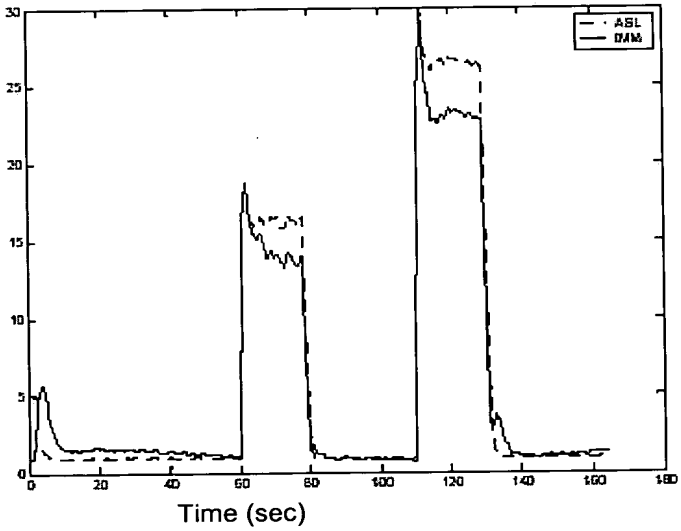


Fig. 11C

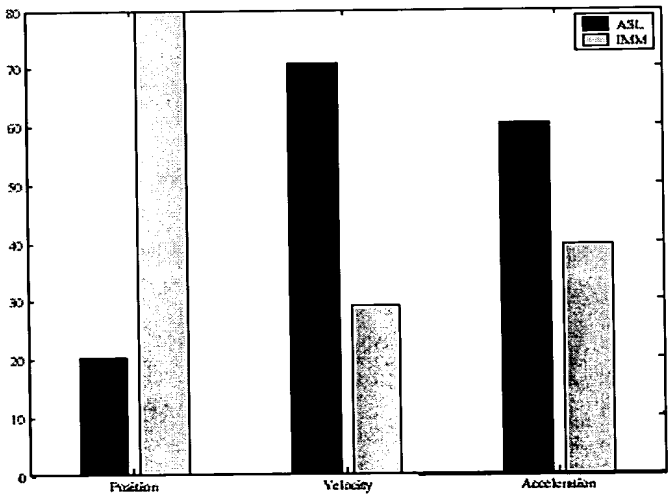


Fig. 11D

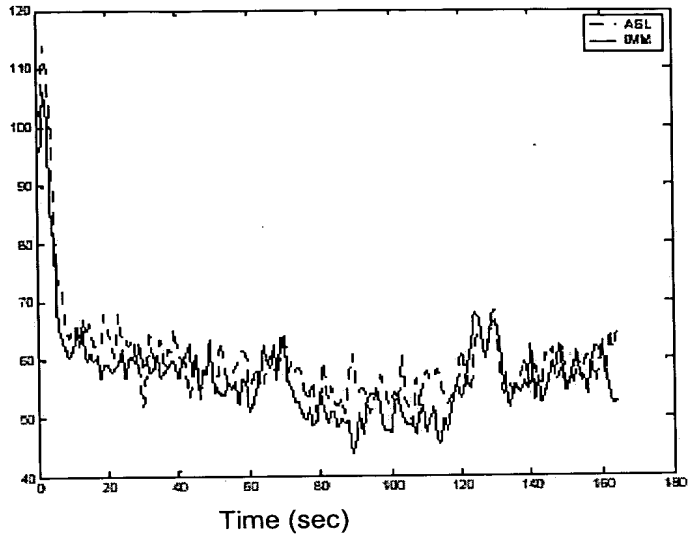


Fig. 12A

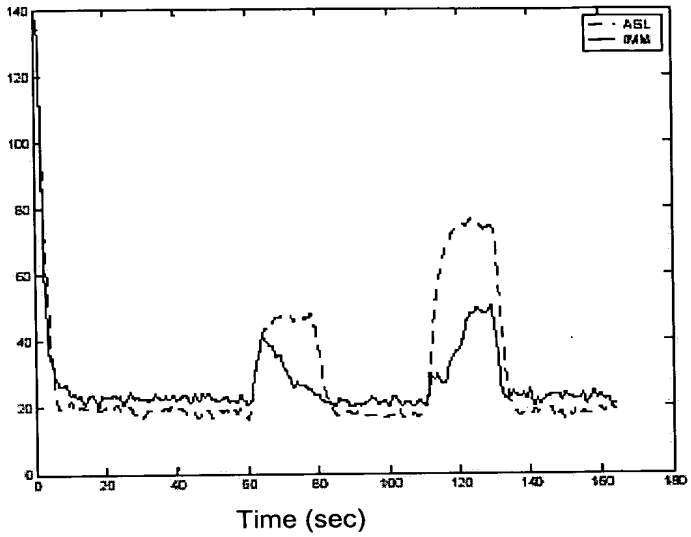


Fig. 12B

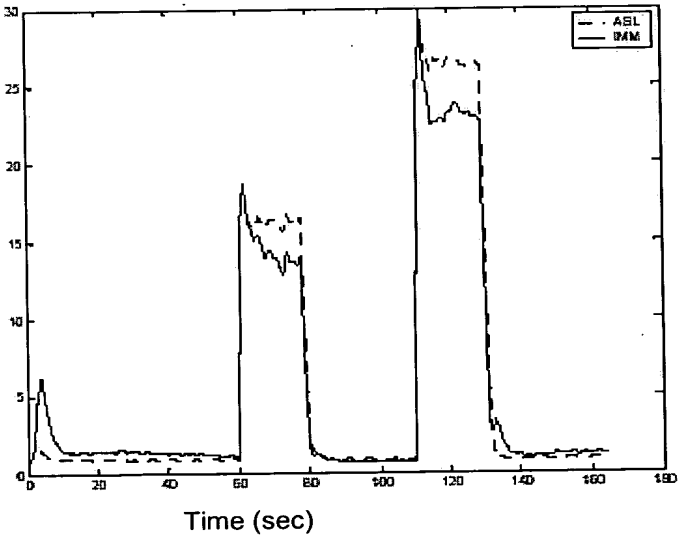


Fig. 12C

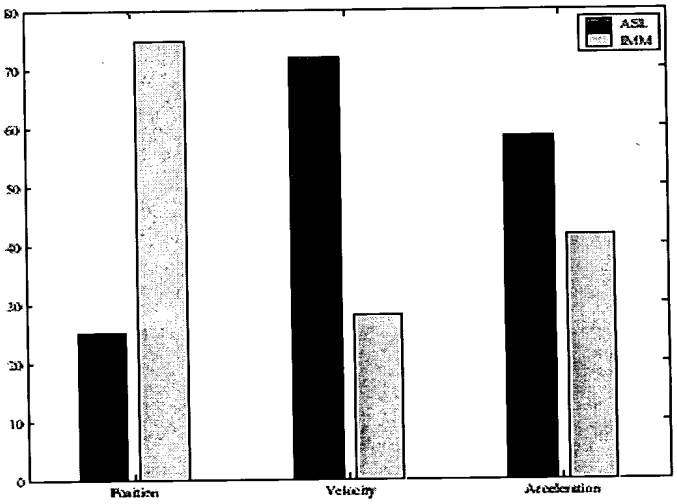


Fig. 12D

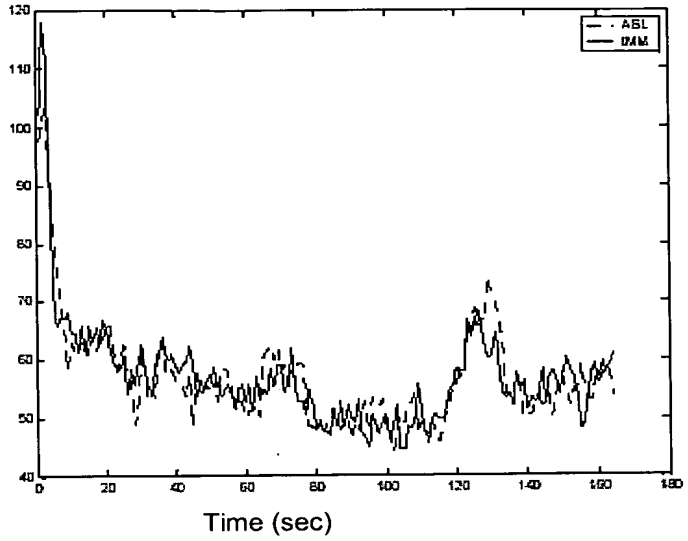


Fig. 13A

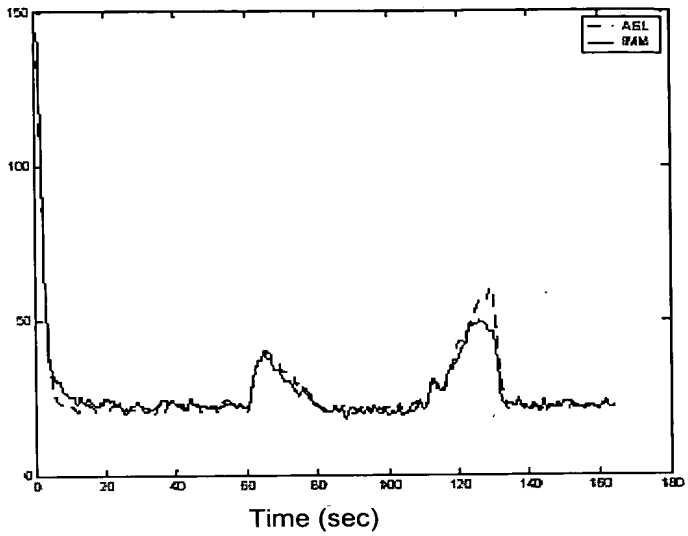


Fig. 13B

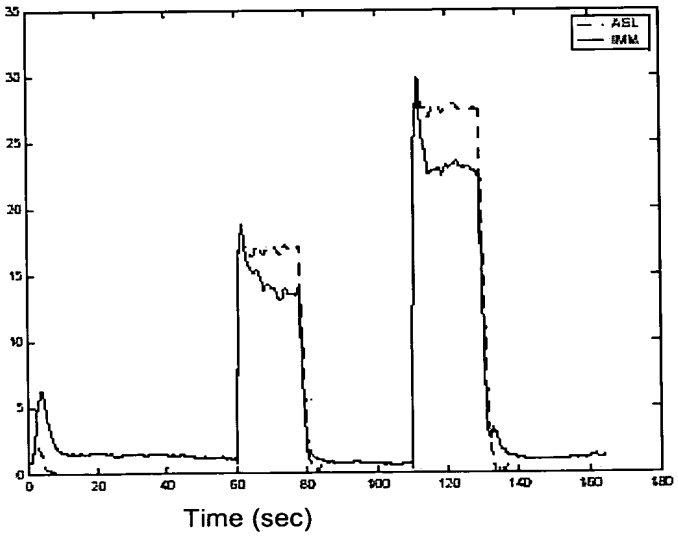


Fig. 13C

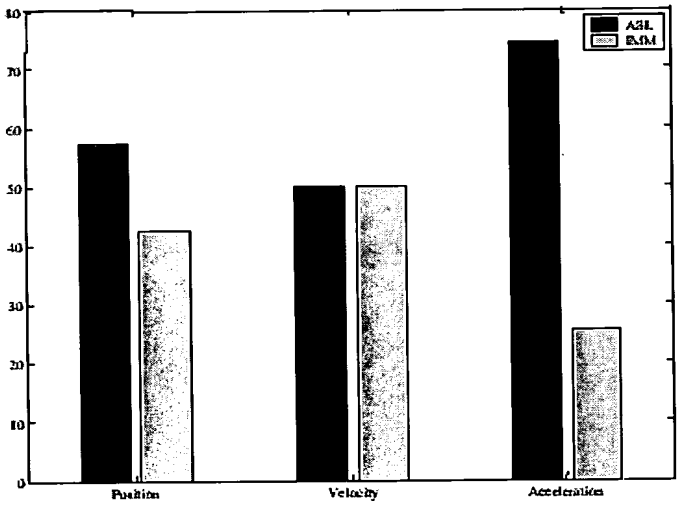


Fig. 13D

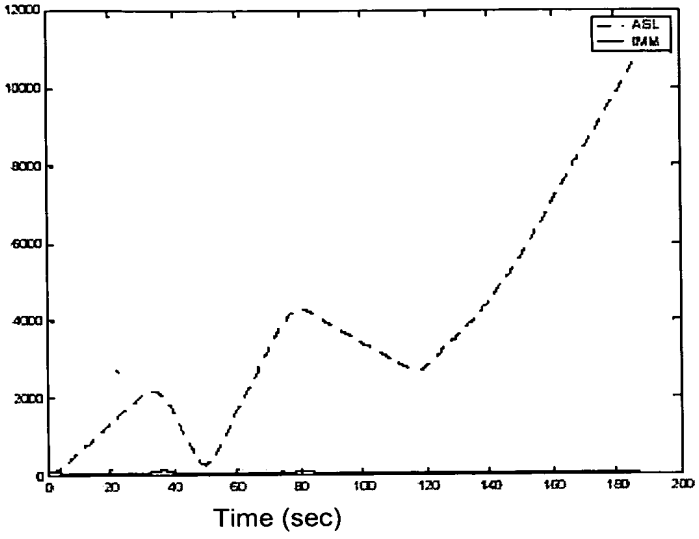


Fig. 14A

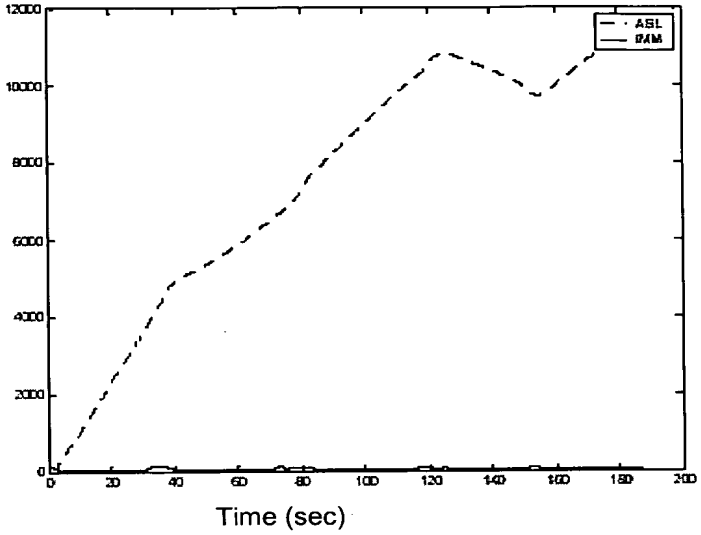


Fig. 14B

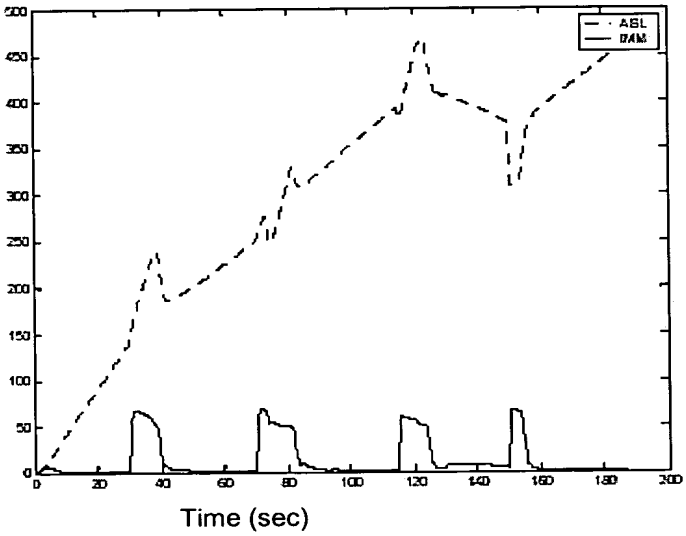


Fig. 14C

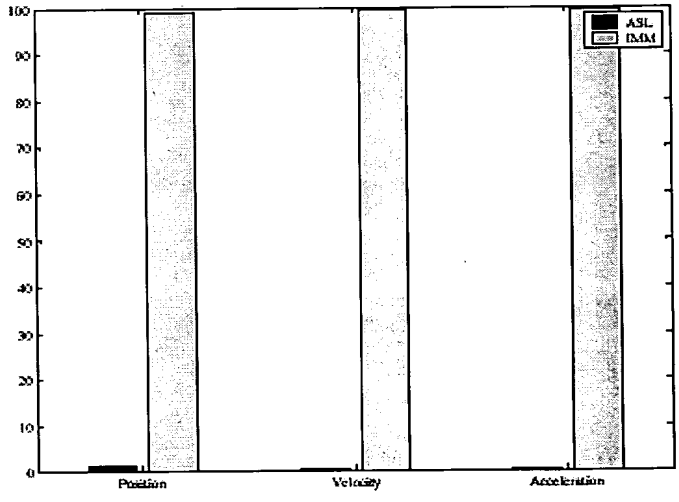


Fig. 14D

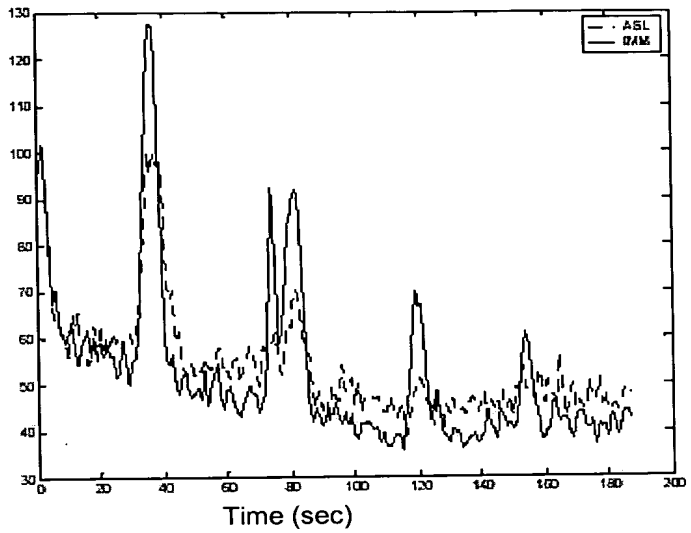


Fig. 15A

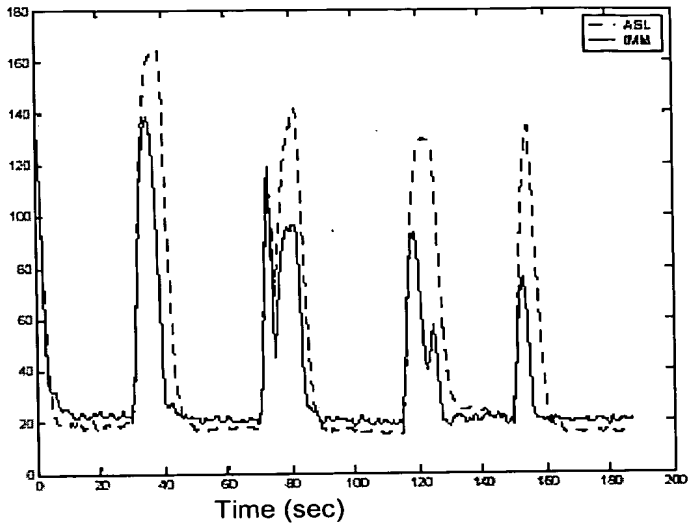


Fig. 15B

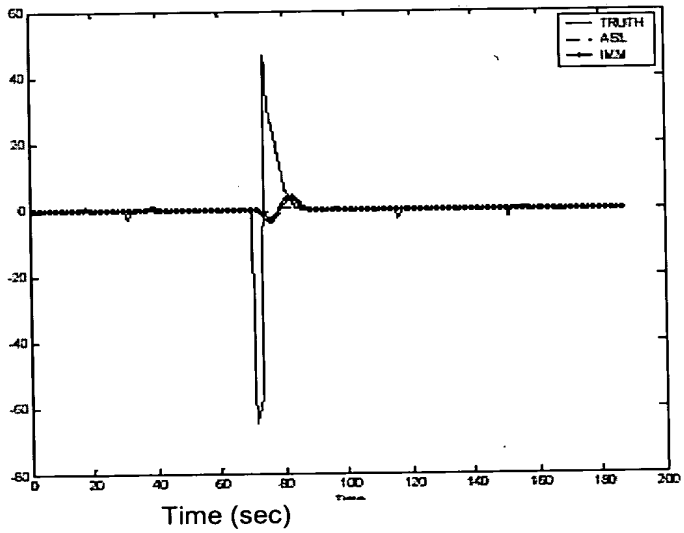


Fig. 15C

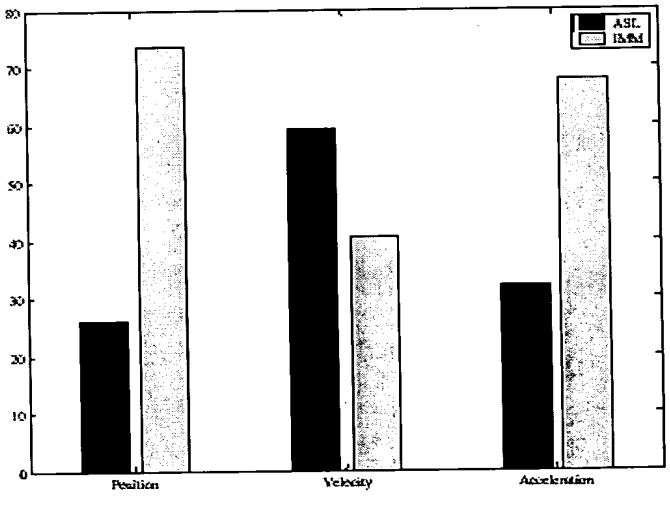


Fig. 15D

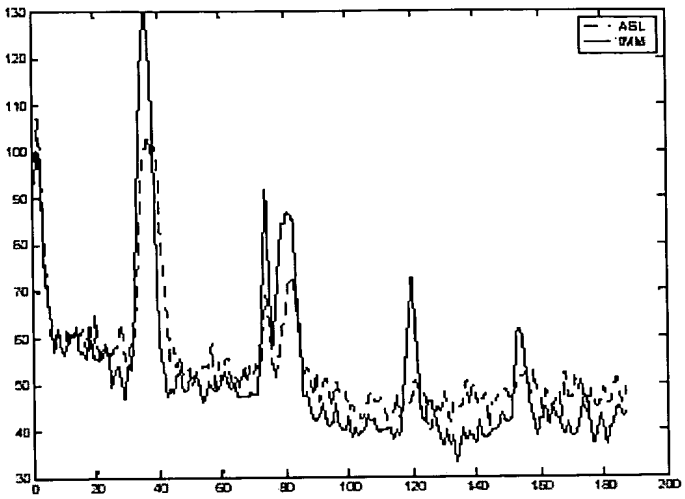


Fig. 16A

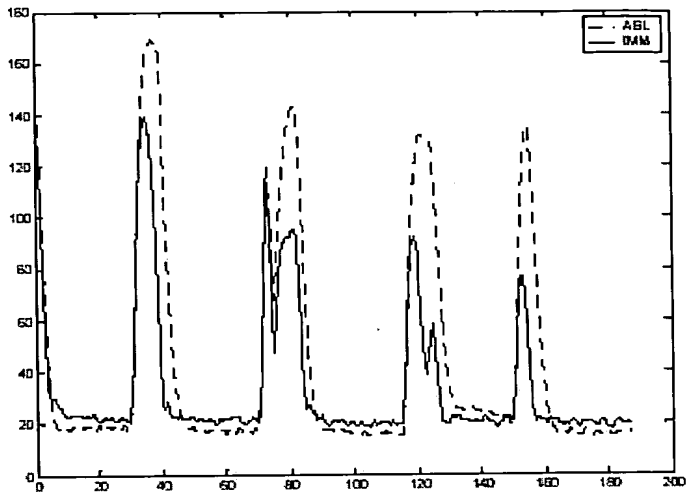


Fig. 16B

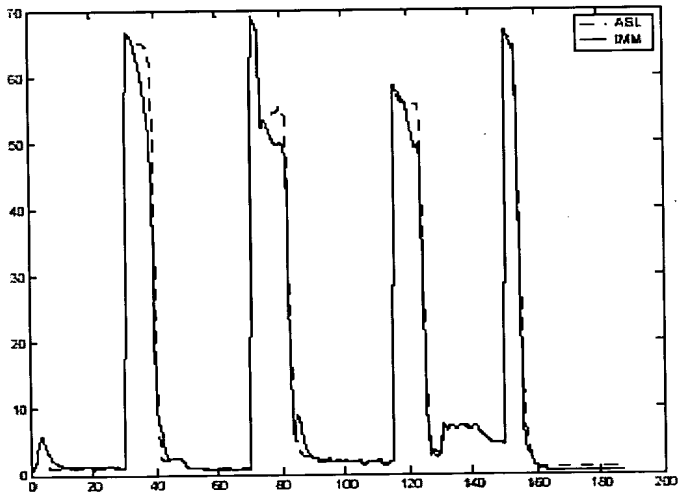


Fig. 16C

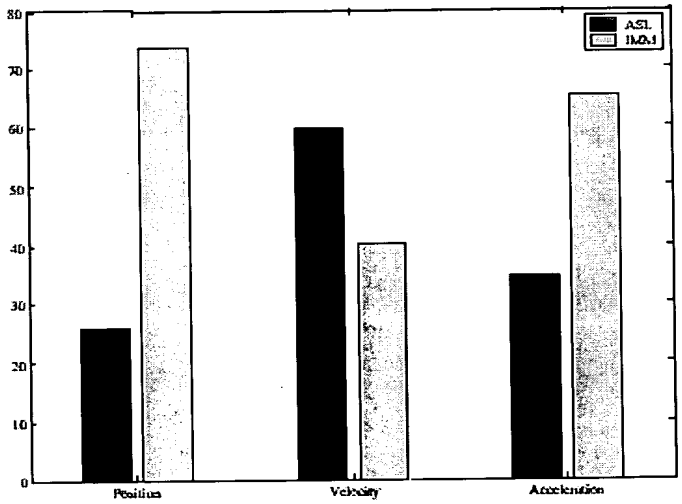


Fig. 16D

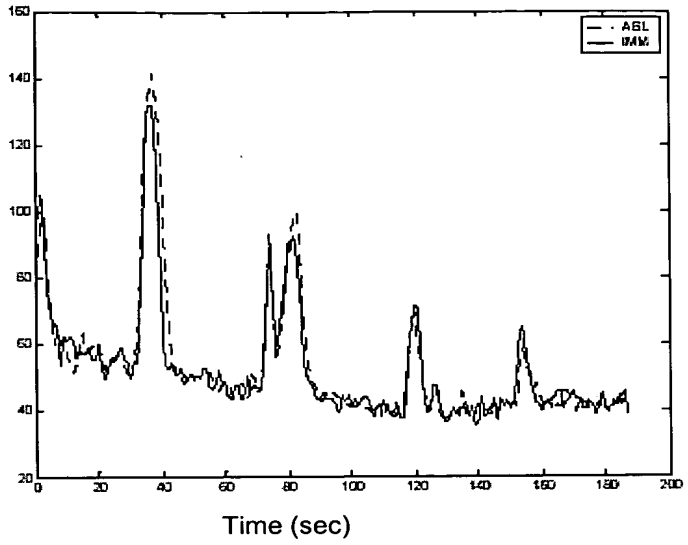


Fig. 17A

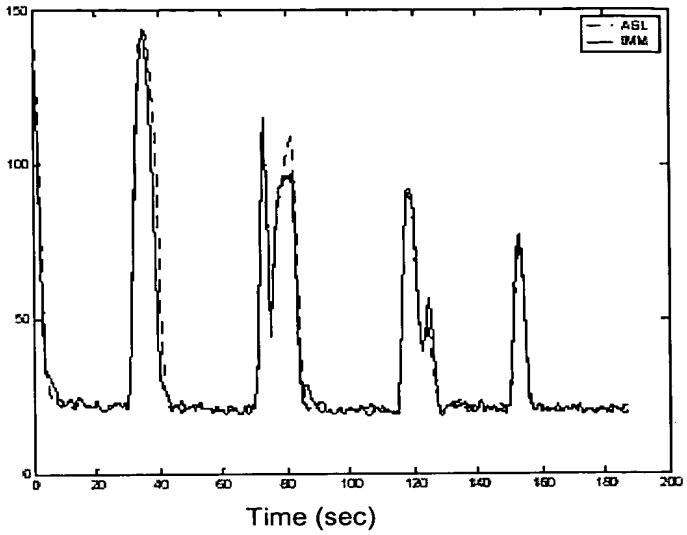


Fig. 17B

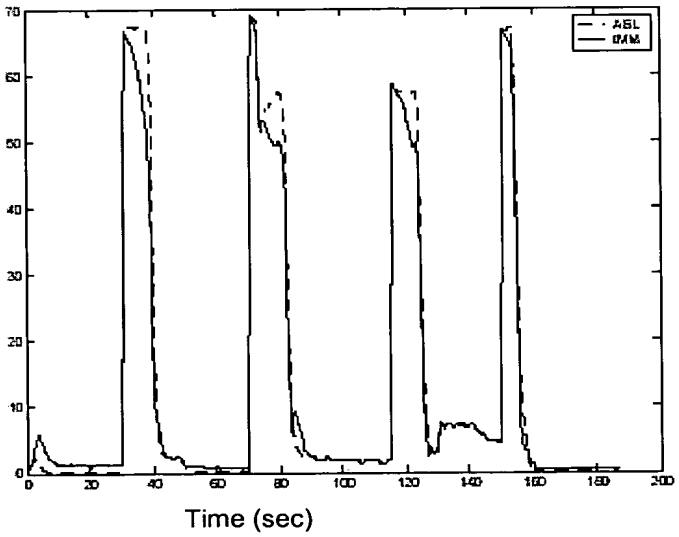


Fig. 17C

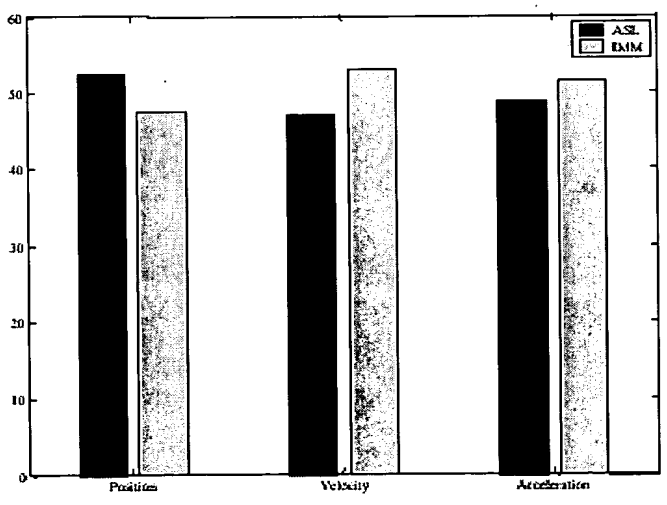
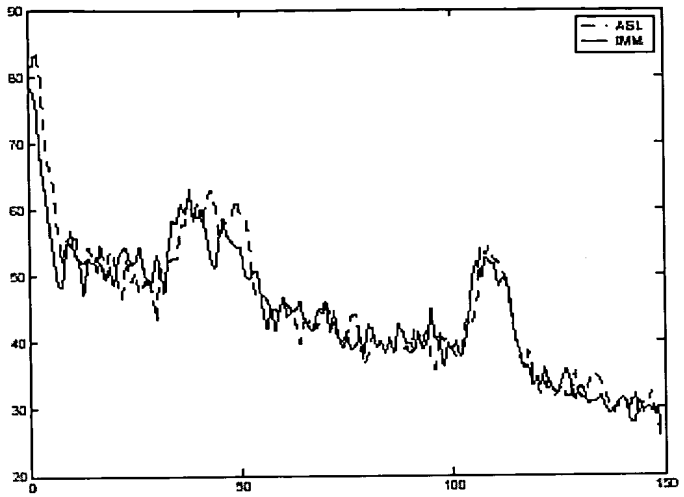
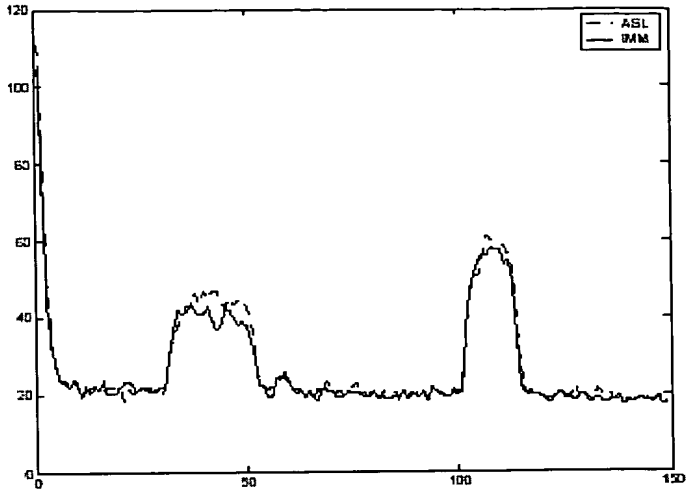


Fig. 17D



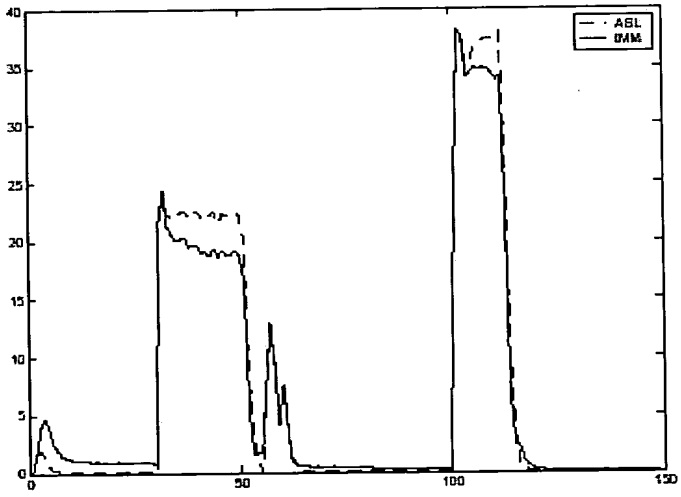
Time (sec)

Fig. 18A



Time (sec)

Fig. 18B



Time (sec)

Fig. 18C

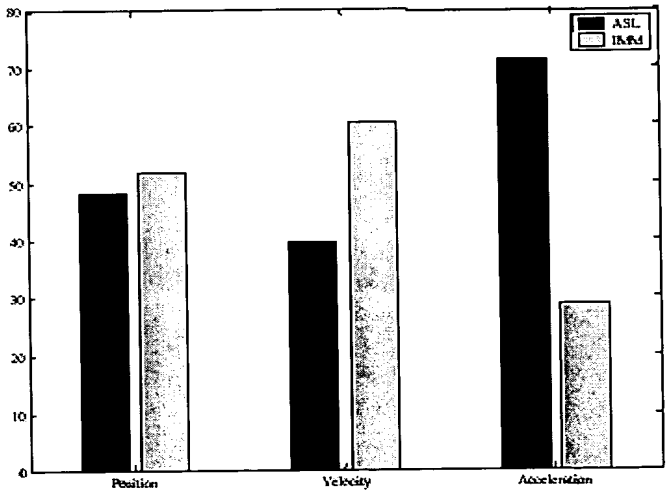


Fig. 18D

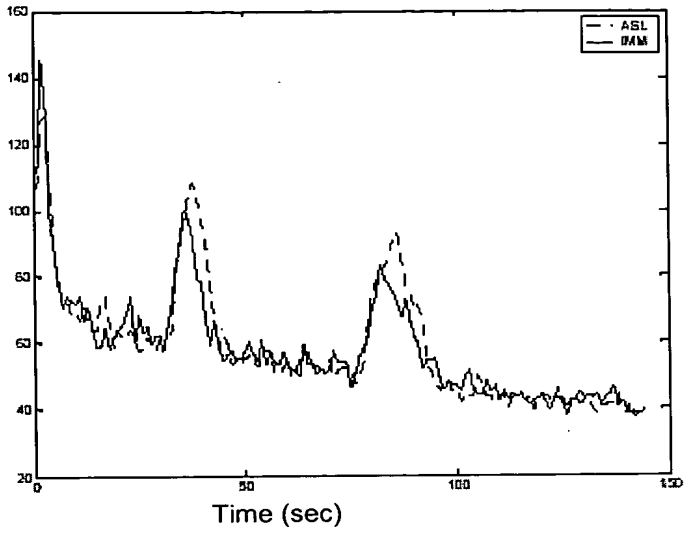


Fig. 19A

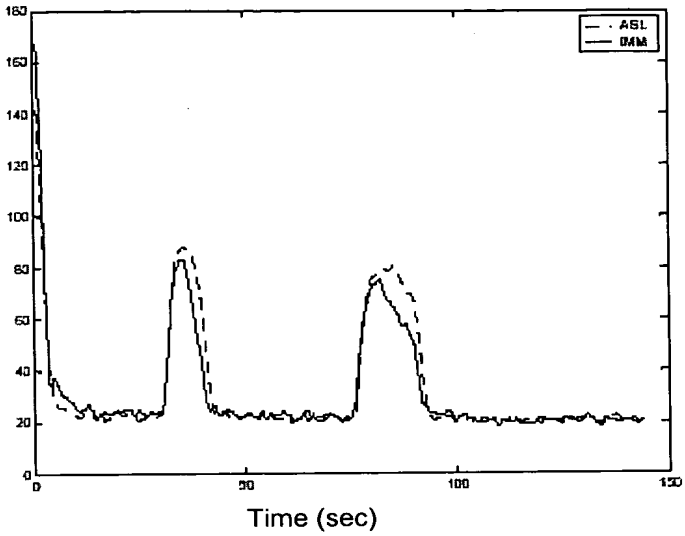


Fig. 19B

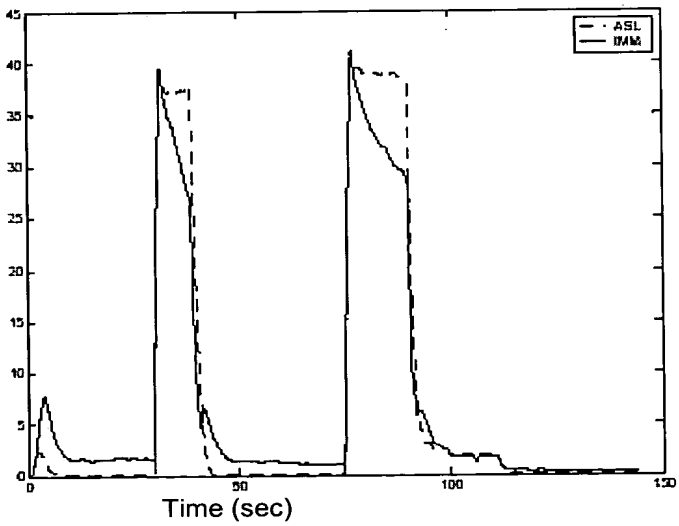


Fig. 19C

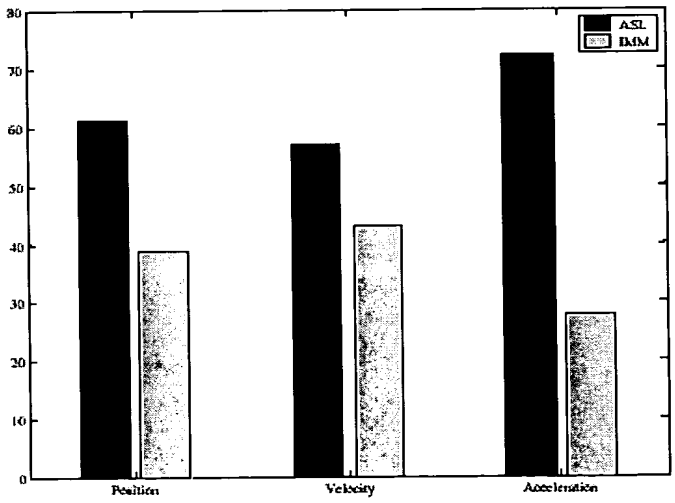


Fig. 19D

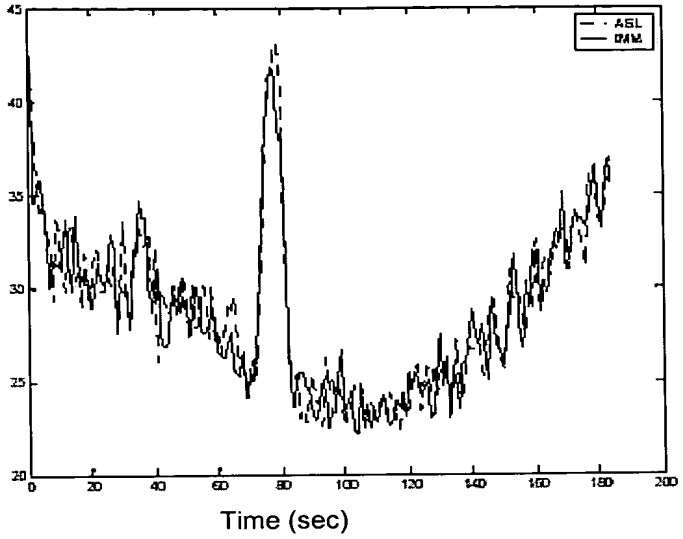


Fig. 20A

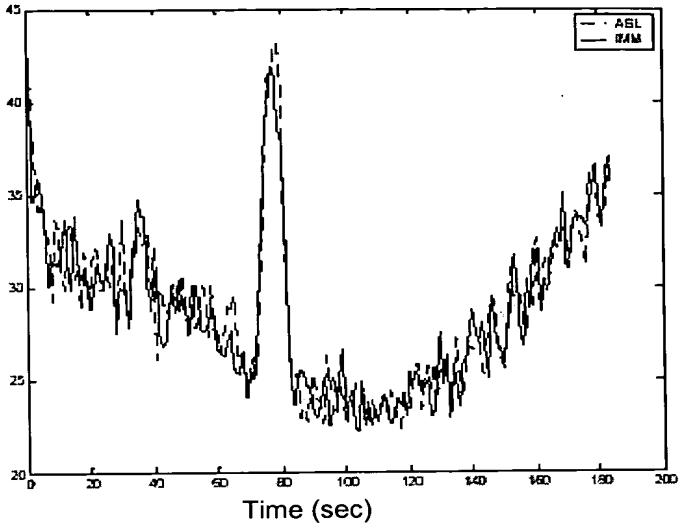


Fig. 20B

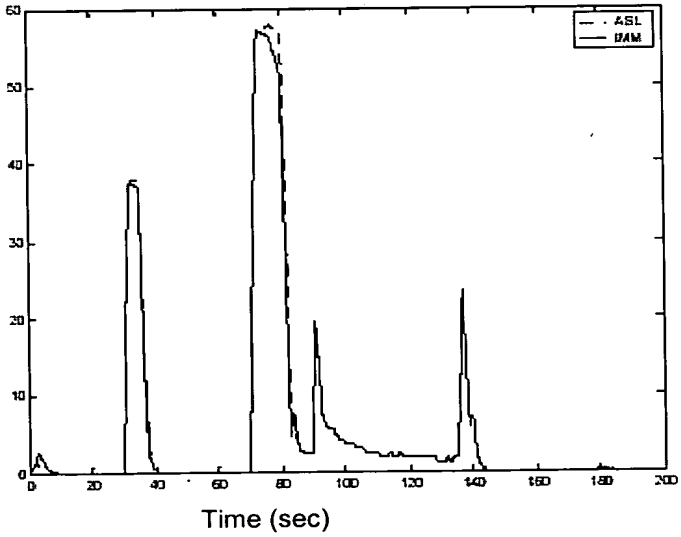


Fig. 20C

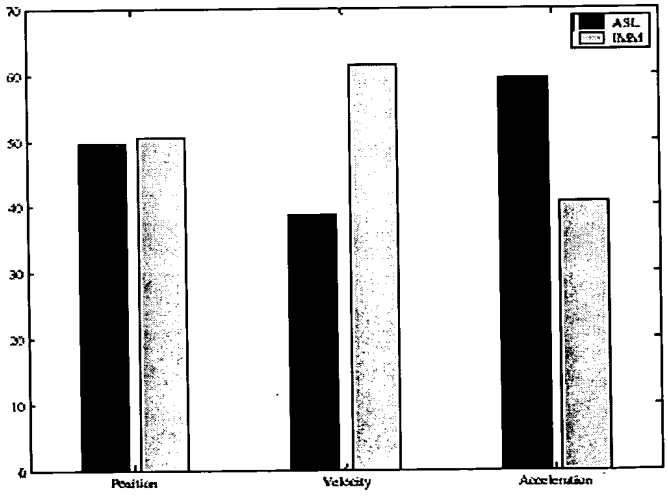


Fig. 20D

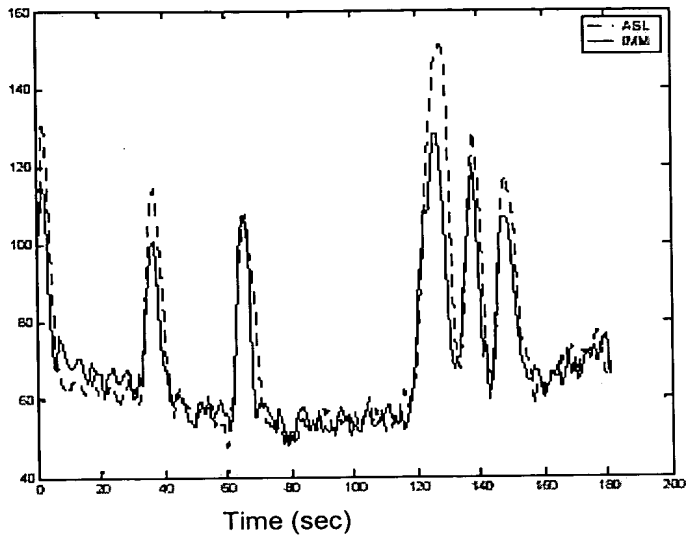


Fig. 21A

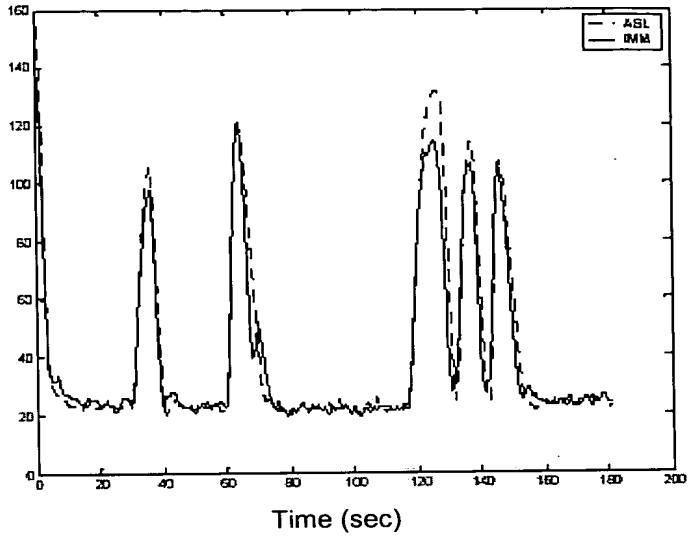


Fig. 21B

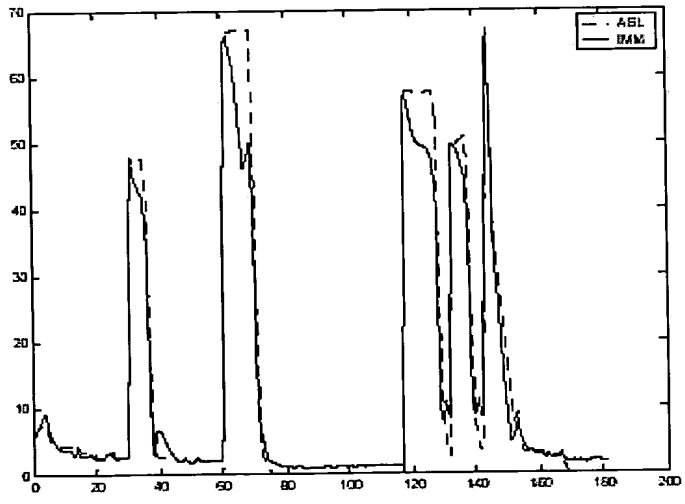


Fig. 21C

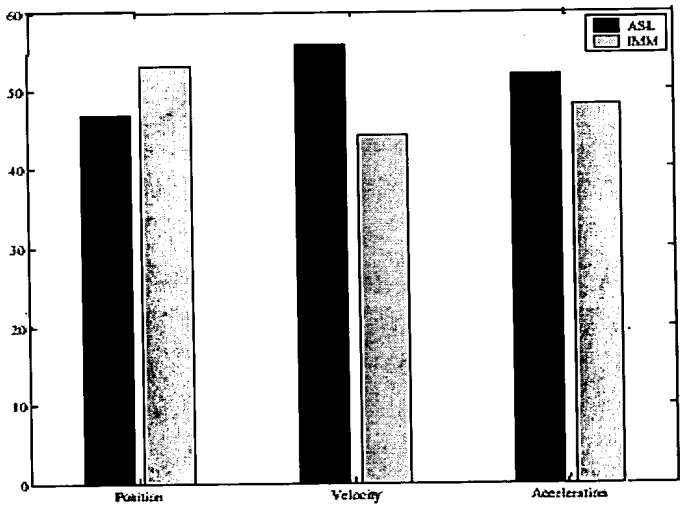


Fig. 21D

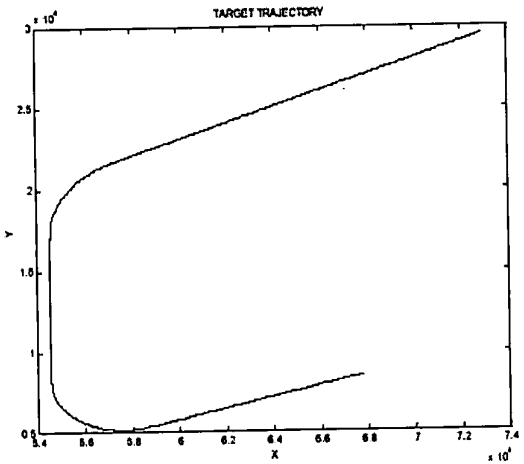


Fig. 9A

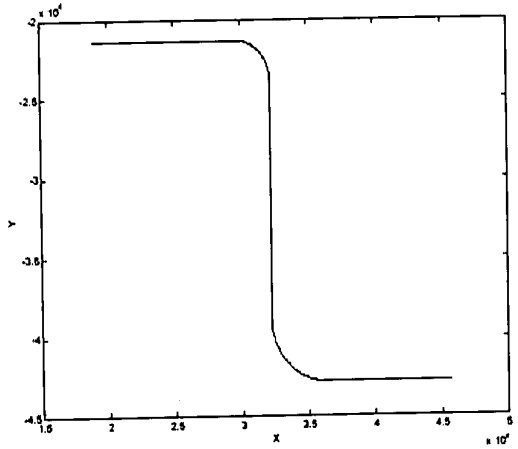


Fig. 9B

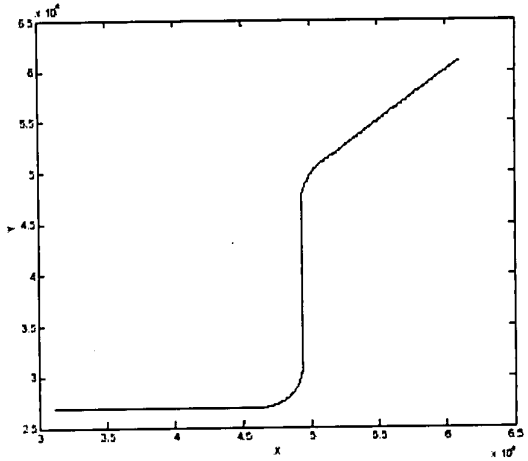


Fig. 9C

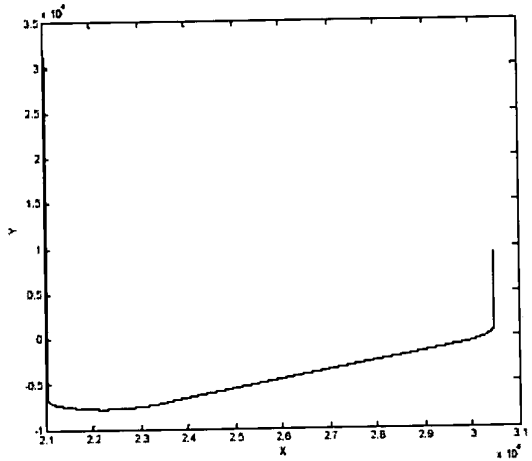


Fig. 9D

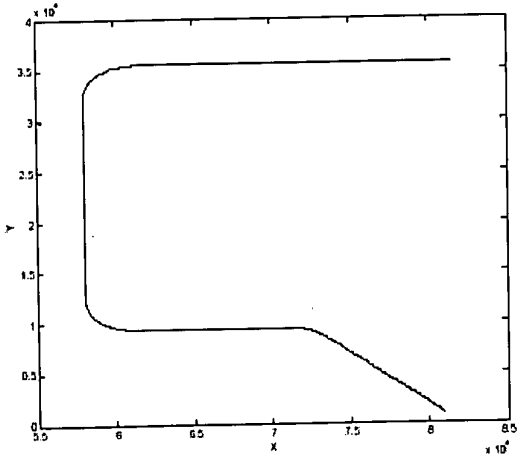


Fig. 9E

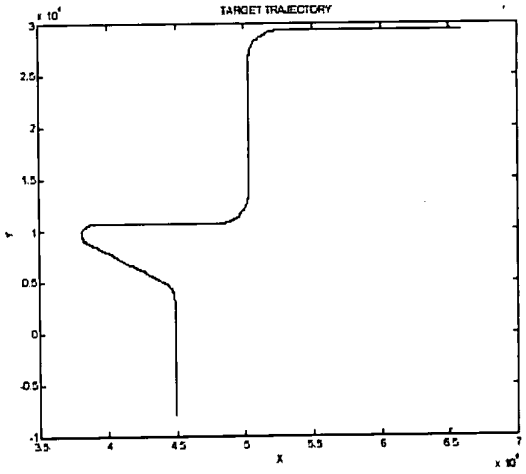


Fig. 9F

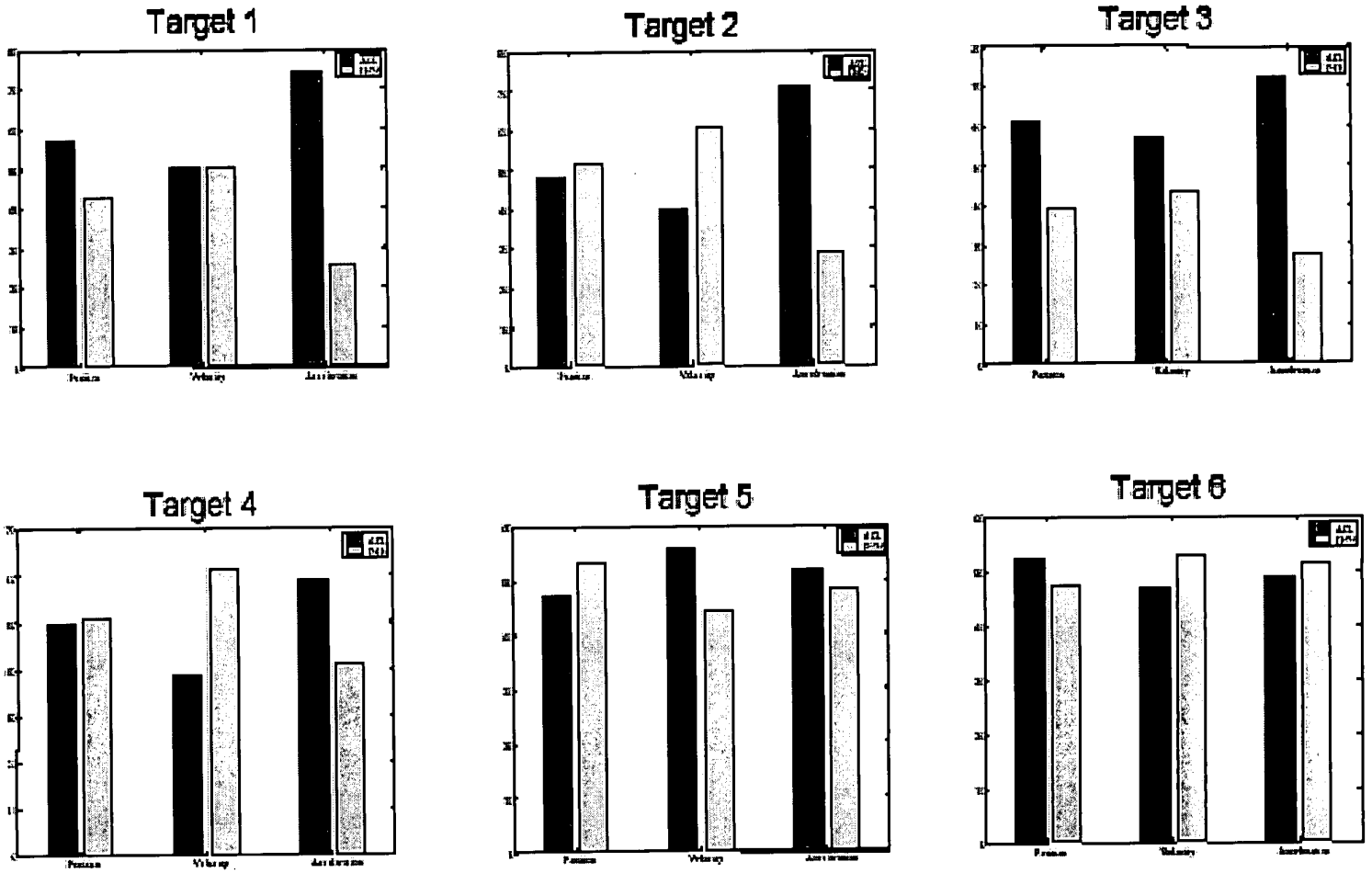
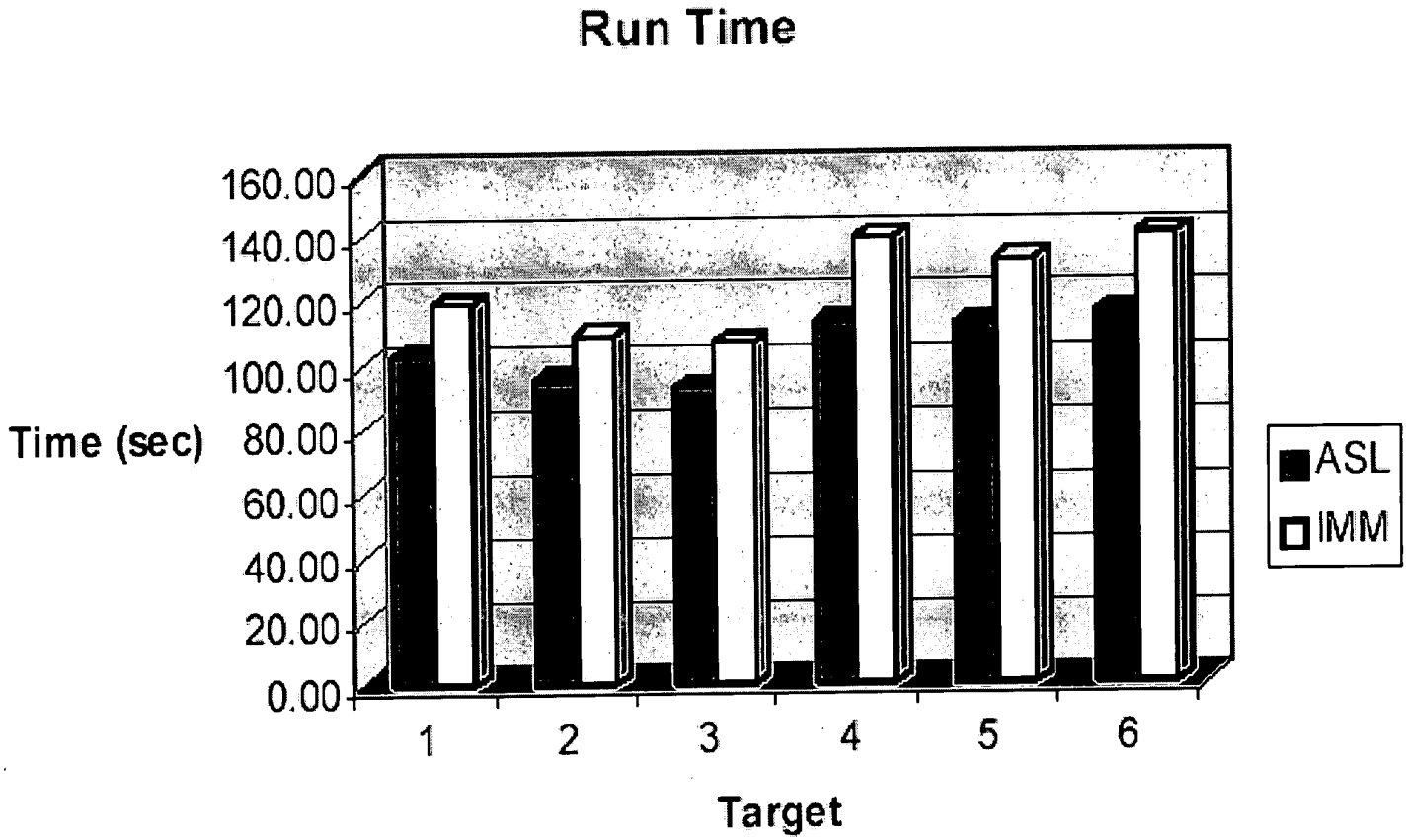


Fig. 22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100.00
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1
2
3
4
5
6
Target
ASL
IMM

Fig. 23

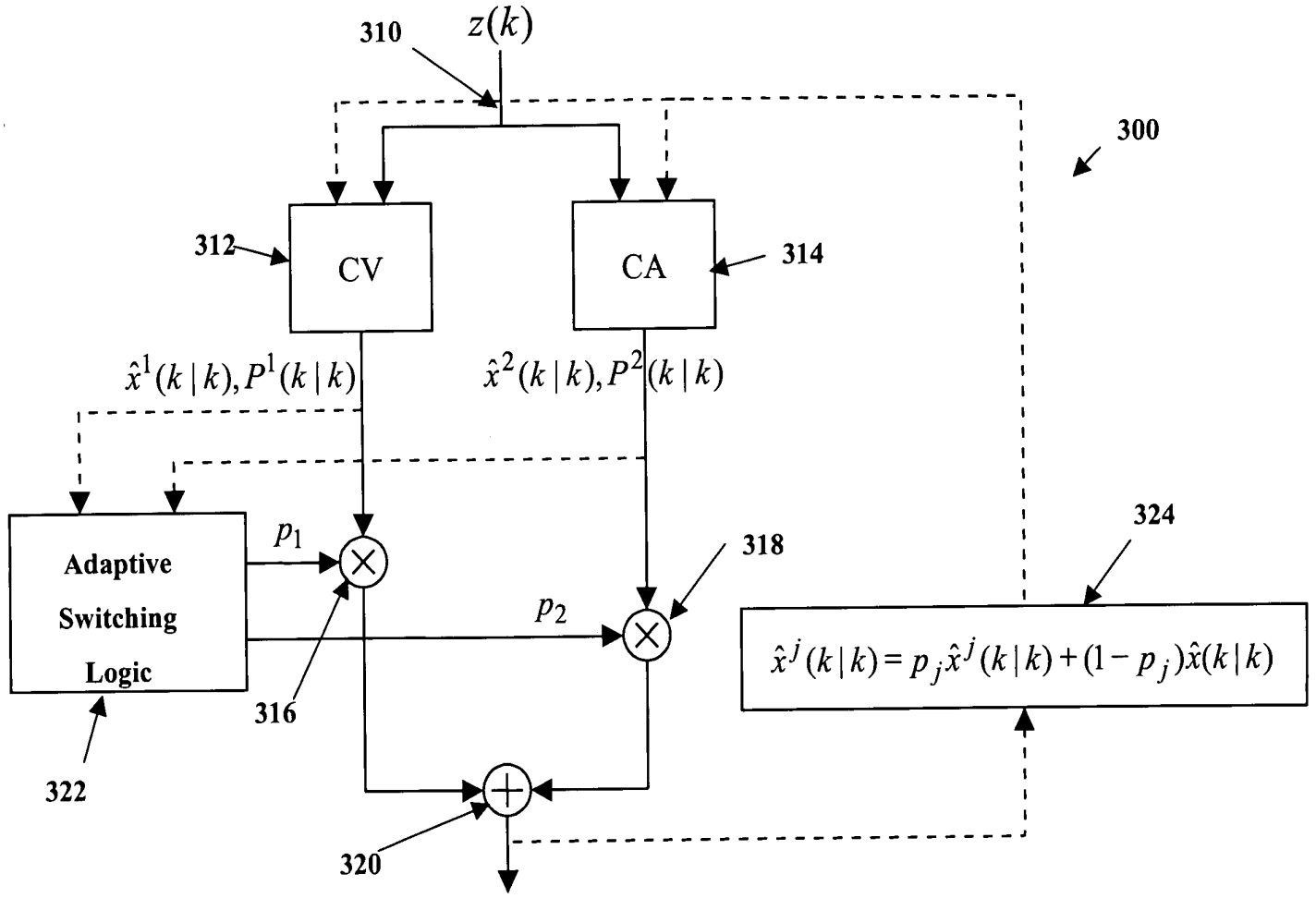

Fig. 7

$$\hat{x}(k|k) = \sum_j p_j \hat{x}^j(k|k)$$